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33rd Part of Report No.AAEE/866/

MINISTRY OF AVIATION

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

SHACKLETON M.R. 2. WR.953
RADIO ACCEPTANCE TRIALS OF A.D.712 RADIO COMPASS [U]

PRESENTED BY

FG.OFF. E. J. MILLER
NAVIGATION AND RADIO DIVISION

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33rd Part of Report No. AAEE/866/1

28 JAN 1963

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Radio Acceptance Trials of A.D.712 Radio Compass

Presented by

Fg.Off. P. J. Miller
Navigation and Radio Division

A. & A.E.E. Ref: ANR/2J3/PJM
H.Q. Ref : D.L.R.D.(A) A.L.10(B)
Period of Trial: February - March, 1962.

Summary

1. Radio Acceptance Trials have been completed on the radio compass A.D.712 installation in Shackleton Mk.2, WR.953.

2. It is recommended that the sense aerial, which underwent trials sited in two positions on the aircraft, be sited on the starboard bomb door.

3. Service Release for use of this equipment in temperate and tropical climates is recommended to an O.A.T. of 40°C at M.S.L.

This report is issued with the authority of

Air Commodore,
Commandant, A. & A.E.E.

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1. Introduction

Radio acceptance trials have been carried out on the Radio Compass AD.712 installation in Shackleton M.R. Mk.2 WR.953. Alternative positions of the sense aerial were provided and assessments made to determine the more suitable position.

2. Reports Issued

There are no other reports that are related to these trials. This report covers the equipment introduced by Mod.988 (Phase II radio modification).

3. Details of the Installation

(a) The installation consisted of a single AD.712 system with dual control. The loop aerial type No. 2829 was mounted above the fuselage in place of the ARI.5428 loop originally fitted, just aft of the escape hatch.

(b) The Q.E. Corrector Unit type No. 4368 was installed on a bracket facing downwards with good accessibility immediately below the loop aerial.

(c) The receiver type No. 2830 was installed on the top radio shelf above the navigator's table at the forward end, aft of the Gee receiver.

(d) Two Remote Control Units type No. 3028 were fitted, one mounted on the pilot's canopy control panel and the other at the navigator's station. The change over switch unit type No. 2834 was mounted on the forward bulkhead '2'.

(e) The two sense aerials were fitted one on the top surface of the fuselage and the other on the starboard bomb door.

4. Comments on the Installation

The installation was satisfactory for ease of operation and servicing and the only criticism was that of the position of the goniometer which was not immediately visible to the navigator in this arrangement.

5. Compatibility Trials

(a) Ground and air compatibility trials were carried out with the following installations serviceable and the AD.712 coverage was searched for any induced noise:-

(i) U.H.F. and Channel Change.
(ii) S.T.R. 18B and channel change.
(iii) Tacan.
(iv) Intercom ARI.18089
(v) V.H.F. and channel change.
(vi) Blue Silk.
(vii) Orange Harvest.
(viii) Sonebuoy IC and blowers.
(ix) Gee
(x) I.L.S.
(xi) Sarah
(xii) G4B Compass
(xiii) Auto Pilot
(xiv) A.Y.F.
(xv) ASV.21
(xvi) All other noise producing electrical equipment.

The results of these trials are shown in Table 1.

(b) During the ground compatibility trials, interference was present on the radio compass AD.712 from the S.T.R. 18B (H.F.). Further and more detailed trials were carried out on these installations when the aircraft was airborne, and Table 2 shows that interference on the radio compass AD.712 from the S.T.R. 18B was present throughout the H.F. band with the upper sense aerial selected. With the lower sense aerial selected interference was only present on four spot frequencies between 7.7 mc/s and 11.15 mc/s. This interference should be brought to the attention of the operating authority.

(c) Slight interference was present on the radio compass during a Sonobuoy IC channel change and from the G4B compass below 250 kc/s only, but these are not considered to be of operational significance.

6. Ground Swings

(a) Ground Swings were carried out with the Q.E. corrector shorted out on frequencies 200, 746, 908 and 1007 kc/s. Those for 200 kc/s and 1007 kc/s are plotted in Figure 1. These swings were difficult to interpret although a semi-circular error was apparent on 200 kc/s. The discrepancies on 746 kc/s and 1007 kc/s were probably due to "Night Effect" - February, the period of the trials, is a particularly bad time of year, the effect extending into the hours of daylight for a longer period than normal.

(b) Results on 200 kc/s clearly indicate the necessity for 2 degrees negative correction and check swings were carried out with -2 degree correction applied. As the stated accuracy of the AD.712 is $\pm 2^{\circ}$ it is considered that setting in a Q.E. correction of -2° is acceptable.

(c) Flight trials were carried out upto the ground swing as detailed below and throughout these trials the performances of the radio compass with the correction of -2 degrees set in was satisfactory.

7. Overhead Performance

The overhead performance of the AD.712 was checked using Langar N.D.B. on 372 kc/s and the results are shown plotted in Fig. 2 and tabulated below:-

(a) Lower Sense Aerial

Altitude in Feet	Groundspeed Kts.	Time in Seconds		
		Start of Turn/Round	Overhead Beacon (Visual)	Finish Turn/Round
2,000'	180	0	8	12
	140	0	4	7
4,000'	180	0	0	9
	140	0	0	6
6,000'	175	2	0	9
	135	0	1	10
10,000' (Gee)	170	0	6	16

(b) Upper Sense Aerial

Altitude in Feet	Groundspeed Kts.	Time in Seconds		
		Start of Turn/Round	Overhead Beacon (Visual)	Finish Turn/Round
2,000'	140	0	0	6
4,000'	180	0	0	10
	140	0		
6,000'	175	0	12	25
10,000'	170	0	10	15
	130	0	10	19

/Satisfactory ...

Satisfactory turn-rounds were achieved on both aerials although difficulty occurred in navigating accurately over a pin point. It was found that only a small offset from directly overhead the beacon caused considerable error in the turn-found time. This effect decreased as the altitude increased but greater difficulties were experienced at higher altitudes in obtaining an accurate pin point, and thus the errors themselves increased.

8. Range Checks

These were made at an altitude of 4,000 ft. on Brookmans Park beacon whose range of power is stated as 50 n.m. Ranges in excess of four times this rated value were obtained.

9. Speed Dives.

Maximum speed dives were made with bomb doors both open and closed and the A.S.V.21 scanner radome in the attack position. After landing an inspection was made of the lower sense aerial and this was found intact.

10. Temperature Checks

(a) The radio compass A.D.712 was instrumentated as follows:-

(i) Air Exhaust Temperature.

(ii) Ambient air temperature - top of receiver.

(iii) I.F. can - internal temperature.

These temperatures were recorded during a low level flight until stabilisation occurred.

(b) The units of the AD.712 installation are cleared for operation in ambient temperatures of up to 55°C. The results of these trials, considere in conjunction with the Shackleton Mk. 2 WB.833 tropical trials data (32nd Part of Report No. AAEE/B66/1 refers), provide a basis for extrapolation of results up to an O.A.T. of +45°C at M.S.L.

(c) The rise above O.A.T. of the ambient air temperature of the receiver unit is 15°C. Release of this equipment is therefore recommended to an O.A.T. of +40°C. Fig. 3 shows the ambient air temperature corrected for an O.A.T. of +40°C at M.S.L.

11. Conclusions

The following conclusions may be drawn from the above results:-

(a) Although there was little difference in the performance of the AD.712 with the sense aerial sited in either position on the aircraft, it is recommended that the sense aerial be sited on the starboard bomb door in which position much less interference from the S.T.R.18B will be present, para. 4(b) refers.

(b) The performance of the radio compass AD.712 was satisfactory and subject to action to para. (a) above Service Release for use in temperate climates is recommended.

(c) Release of this equipment is recommended for use in tropical climates up to an O.A.T. of +40°C at M.S.L.

/Circulation List ...

Circulation List

DLRDA/AL.10	3 Copies 1 for Action
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RDT3	1 Copy
TIL	70 Copies
R.A.E.	6 Copies
R.A.E. Bedford	2 "
R.T.O., A. V. Roe & Co. Ltd.	2 "

TABLE I

COMPATIBILITY TRIALS

Equipment	Interference on AD.712 249/723/368 KC/S
U.H.F. 399 mc/s 250 " 200 "	Nil Nil Nil
S.T.R. 18B	See Fig. 2
TACAN	Nil
Intercom ARI.18089	Nil
V.H.F. 122.5 mc/s 123.3 " 117.9 " 121.5 " 103.86 " 190.58 " 132.2 "	Nil " " " " " "
Blue Silk	Nil
Orange Harvest	Nil
Sonobuoy IC	SLIGHT during channel change
Gee	Nil
I.F.S.	Nil
Sarah	Nil
G4B Compass	Interference on loop only below 250 kc/s
Autopilot	Nil
A.Y.F.	Nil
A.S.V. 21	Nil
Fuel Pumps	Nil
De-icing wings and tail leading edge	Nil
Galley	Nil
Gun Turrets	Nil
Radiator Flaps	Nil

TABLE 2

S.T.R. 18B INTERFERENCE ON RADIO COMPASS A.D.712

STR. 18B Frequency mc/s	AD.712 Frequency kc/s	Port H.F. Aerial		Stbd. H.F. Aerial	
		Bottom Sense Aerial	Top Sense Aerial	Bottom Sense Aerial	Top Sense Aerial
6.58	249 344 723.5	Nil		Slight	Heavy " "
5.589	249 344 723.5				Heavy " "
3.022	249 344 723.5				Heavy "
15.8	249 344 723.5		Slight Slight Slight	Slight	Heavy " "
2.442	249 344 723.5		Heavy Heavy Heavy		Heavy " "
4.025	249 344 797		Heavy Some		Slight " Some
5.252	249 344 797				Heavy Heavy
7.755	249 344 797	Some Some	Some Some	 Some Slight	Some " "
11.15	249 344 797	Some " "	 Some	Slight	Heavy " "
8.82	249 344 797	 Key clicks	 Key clicks		Heavy " "
9.505	249 344 797	Some Some	Some Some Some	 Some	Heavy Some

SK N°B 1424 | 33rd PART OF REPORT Nº A&AEE/866/1 | SHACKLETON MR MK 3 WR 953 | TRAEN | CH NR WITNESS | AF...

RADIO COMPASS GROUND SWINGS.

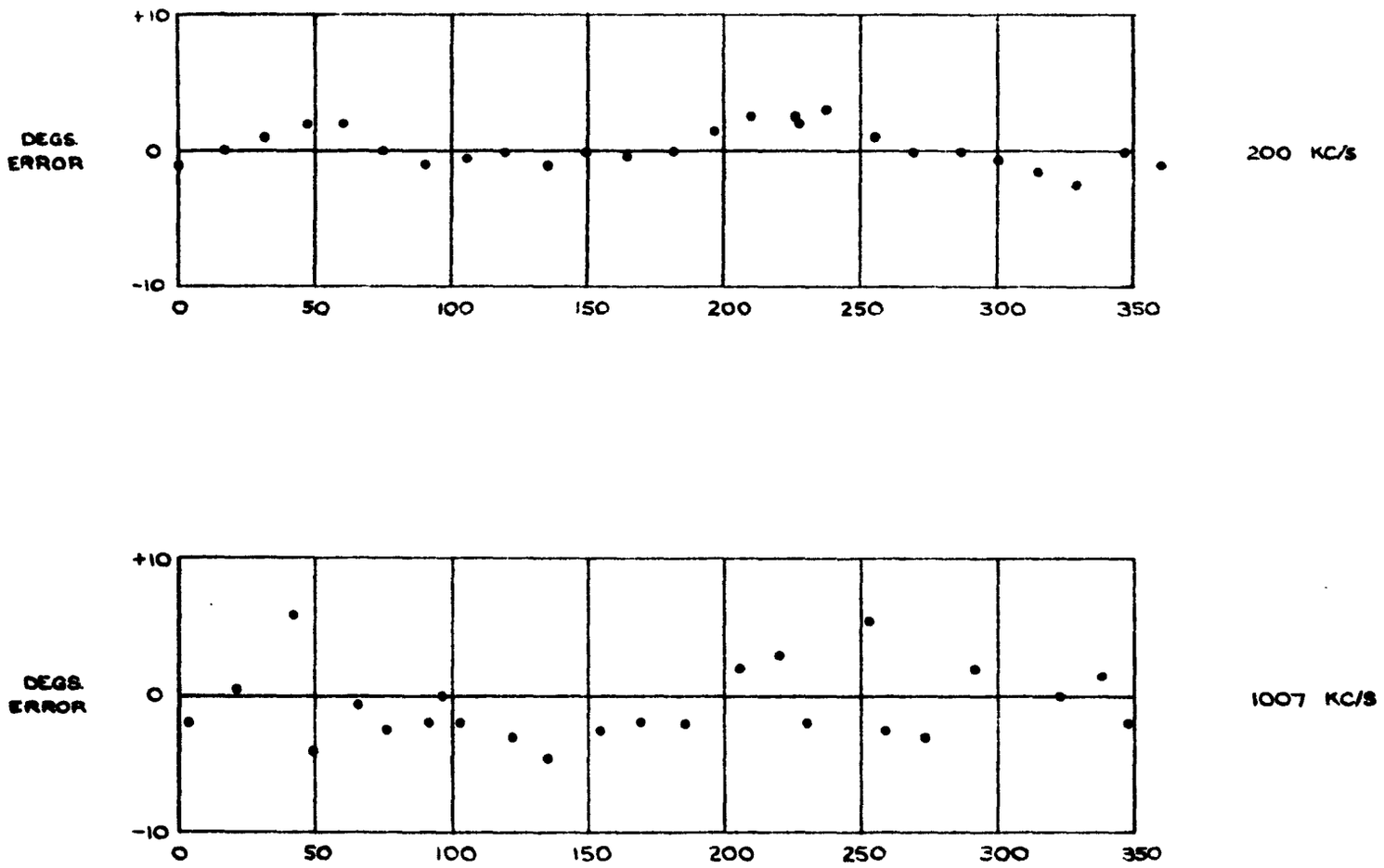
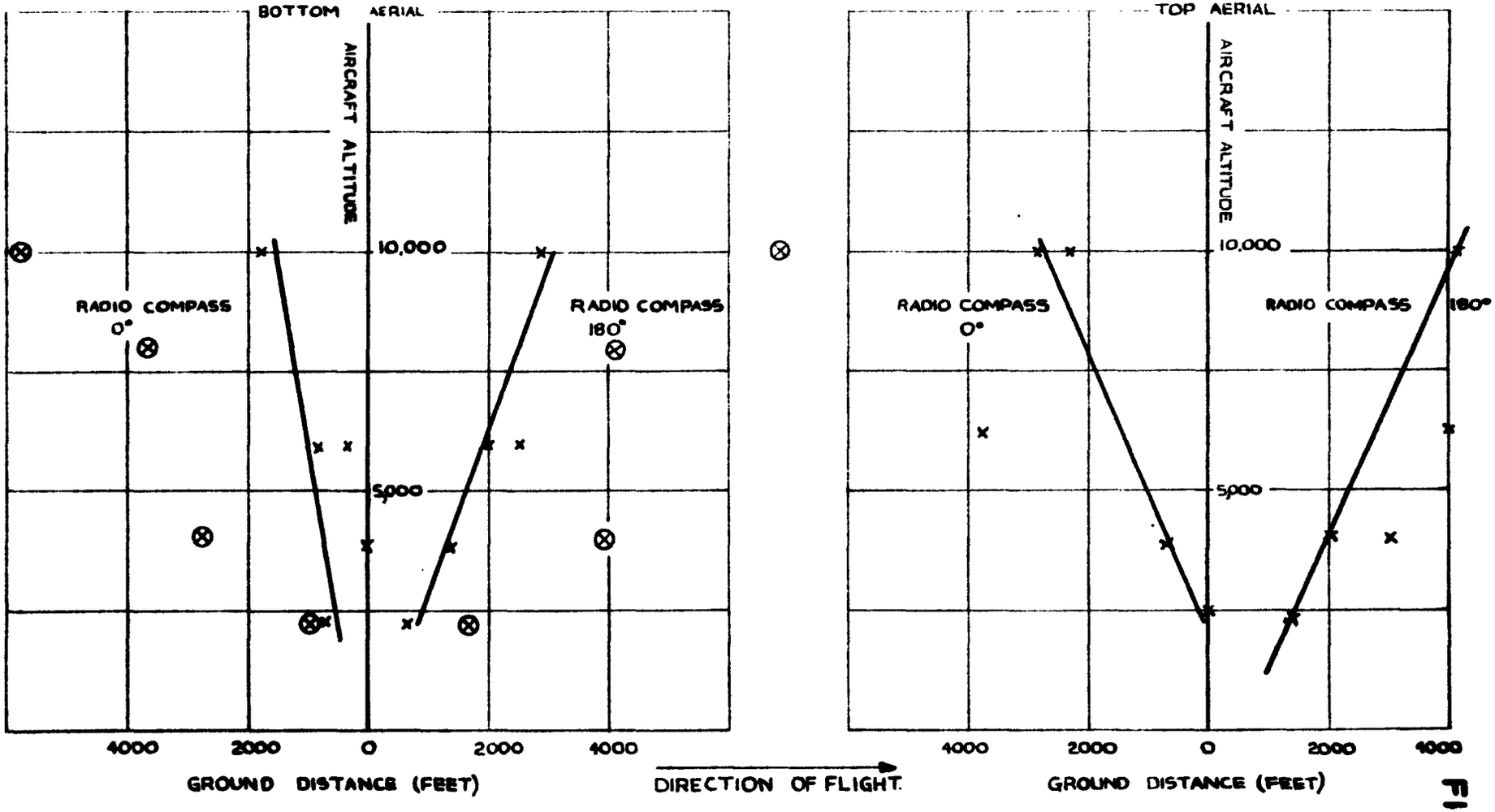


FIG. 1.

SK Nº B1425 | 33RD PART OF REPORT Nº A & AEE/B66/1 | SHACKLETON MR MK 2 WR 952 | [illegible] | Cr. MR WITHERS | APP [illegible] | W.R. 12-11-62



OVERHEAD PERFORMANCE OF THE RADIO COMPASS AD 712

FIG.2

SKN°81426	33RD PART OF REPORT N° A&AEE/866/1	SHACKLETON MR MK2. WR953	TR S J H	CH F/C MILLER	APP Kind. for S of YR	E 1 63

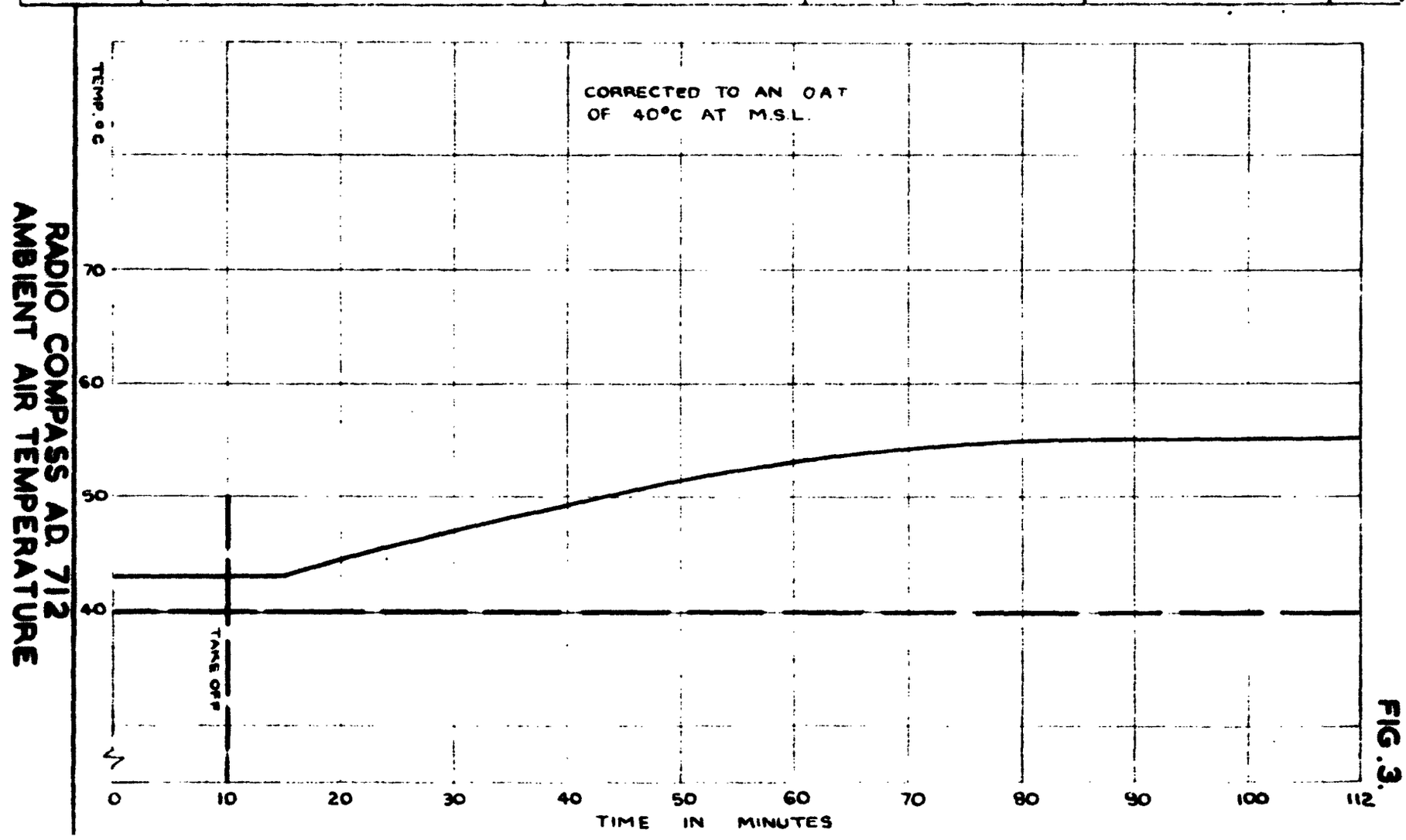


FIG. 3.

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